CLAIMS

We Claim:

1. An apparatus for manufacturing a chiral fiber from a UV-sensitive optical fiber having a core and a refractive index, comprising:

rotating means for rotating the optical fiber about its longitudinal axis;

radiation means for exposing a portion of the optical fiber core to UV radiation configured to alter a refractive index of the optical fiber; and

moving means for moving the optical fiber along its longitudinal axis relative to said UV radiation beam while said rotating means is active to impose a chiral refractive index modulation over a selected length of the optical fiber.

2. The chiral fiber manufacturing apparatus of claim 1, wherein the optical fiber comprises a first end and a second end and wherein said rotating means comprises:

a first rotation unit having a first holding device for retaining said first end of the optical fiber; and

a second rotation unit having a second holding device for retaining said second end of the optical fiber, said first and second rotation units being operable to rotate the optical fiber about its longitudinal axis at a predetermined rotation speed.

3. The chiral fiber manufacturing apparatus of claim 1, wherein said radiation means is stationary and wherein said rotating means are positioned on said moving means such that said optical fiber is moved along its longitudinal axis and exposed to said stationary radiation means.

4. The chiral fiber manufacturing apparatus of claim 1, wherein said rotation means further comprises:

securing means for securely retaining the optical fiber during rotation; and

tensioning means for maintaining tension in the optical fiber during rotation and motion of the fiber.

5. The chiral fiber manufacturing apparatus of claim 2, wherein the said motion means comprises a linear translation stage and wherein said first and said second rotation units are positioned thereon.

6. The chiral fiber manufacturing apparatus of claim 2, wherein the said motion means comprises a first linear translation stage for mounting said first rotation unit and an independent second linear translation stage for mounting said second rotation unit.

7. The chiral fiber manufacturing apparatus of claim 6, wherein the said first and said second linear translation stages are configured to maintain tension in the optical fiber.

8. The chiral fiber manufacturing apparatus of claim 1, wherein said radiation means comprises:

a UV laser operable to emit a UV beam; and

a first focusing unit for focusing said UV beam into a focused UV beam, wherein said UV laser and said first focusing unit are positioned such that said focused UV beam irradiates a portion of the optical fiber core during rotating and linear motion of the optical fiber.

9. The chiral fiber manufacturing apparatus of claim 8, wherein said radiation means further comprises at least one reflecting device for reflecting said UV beam into said first focusing unit.

10. The chiral fiber manufacturing apparatus of claim 8, wherein said first focusing unit comprises at least one focusing lens.

11. The chiral fiber manufacturing apparatus of claim 1, wherein said rotating means is stationary with respect to linear motion, and wherein said radiation means are positioned on said moving means such that said UV

radiation beam is moved along the longitudinal axis of the optical fiber thereby imposing chiral modulation on the optical fiber refractive index.

12. The chiral fiber manufacturing apparatus of claim 1, wherein the optical fiber comprises a first end and a second end and wherein said rotating means comprises:

a rotation unit having a holding device for retaining said first end of the optical fiber; and

a freely rotatable support device for retaining said second end of the optical fiber and for tensioning the optical fiber, said rotation unit being operable to rotate the optical fiber about its longitudinal axis at a predetermined rotation speed.

13. The chiral fiber manufacturing apparatus of claim 1, wherein said chiral refractive index modulation is selected from: a single helix modulation and a double helix modulation.

14. The chiral fiber manufacturing apparatus of claim 8, further comprising first directing means for directing said focused UV beam, during operation of said rotating means and said moving means, into a center portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, to produce a double helix chiral modulation in the optical fiber.

15. The chiral fiber manufacturing apparatus of claim 14, wherein said first directing means comprises at least one mirror.

16. The chiral fiber manufacturing apparatus of claim 8, further comprising second directing means for directing said focused UV beam, during operation of said rotating means and said moving means, into a outer portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, to produce a single helix chiral modulation in the optical fiber.

17. The chiral fiber manufacturing apparatus of claim 16, wherein said second directing means comprises at least one mirror.

18. The chiral fiber manufacturing apparatus of claim 8, further comprising:

a second focusing device positioned sequentially to said first focusing device operable to produce a collimated UV beam from said focused UV beam; and

third directing means for directing said collimated UV beam, during operation of said rotating means and said moving means, into a center portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, to produce a double helix chiral modulation in the optical fiber.

19. The chiral fiber manufacturing apparatus of claim 18, wherein said third directing means comprises at least one mirror.

20. The chiral fiber manufacturing apparatus of claim 8, further comprising:

a third focusing device operable to produce a second focused UV beam from said UV laser beam;

fourth directing means for directing said focused UV beam, during operation of said rotating means and said moving means, into a center portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, and

fifth directing means, positioned directly opposite and aligned with said fourth directing means, for directing said second focused UV beam, during operation of said rotating means and said moving means, into a center portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, such that said focused UV beam and said second focused UV beam coincide with one another at said central portion of the optical fiber core to produce a double helix chiral modulation in the optical fiber.

21. The chiral fiber manufacturing apparatus of claim 20, wherein said fourth and fifth directing means each comprise at least one mirror.

22. The chiral fiber manufacturing apparatus of claim 8, further comprising:

a fourth focusing device operable to produce a third focused UV beam from said UV laser beam;

sixth directing means for directing said focused UV beam, during operation of said rotating means and said moving means, into a first outer portion of the optical fiber core perpendicular to the optical fiber longitudinal axis, and

seventh directing means, positioned opposite to and offset from said sixth directing means, for directing said third focused UV beam, during operation of said rotating means and said moving means, into a second outer portion of the optical fiber core perpendicular to the optical fiber longitudinal axis and opposite to said first outer portion, to produce a double helix chiral modulation in the optical fiber.

23. The chiral fiber manufacturing apparatus of claim 22, wherein said sixth and seventh directing means each comprise at least one mirror.

24. A method for manufacturing a chiral fiber from a UV-sensitive optical fiber having a core and a refractive index, comprising the steps of:

(a) rotating the optical fiber about its longitudinal axis;

(b) exposing a portion of the optical fiber core to UV radiation configured to alter a refractive index of the optical fiber; and

(c) during said steps (a) and (b), moving the optical fiber along its longitudinal axis relative to said UV radiation to impose a chiral refractive index modulation over a selected length of the optical fiber.

25. The method of claim 24, further comprising the step of:

(d) during said step (c) maintaining tension in the optical fiber.

26. The method of claim 24, further comprising the step of:

(e) during said step (d) positioning and directing said UV radiation to produce a single helix refractive index modulation in the optical fiber

27. The method of claim 24, further comprising the step of:

(f) during said step (d) positioning and directing said UV radiation to produce a double helix refractive index modulation in the optical fiber

28. The method of claim 24, further comprising the step of:

(g) during said step (b) exposing said portion of the optical fiber core to additional UV radiation to produce a double helix refractive index modulation in the optical fiber.

29. The method of claim 24, further comprising the step of:

(h) during said step (b) exposing a second portion of the optical fiber core to a further UV radiation to produce a double helix refractive index modulation in the optical fiber.